New Approaches to Shellfish Protection in Puget Sound

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Abstract

The cool, clean waters of Puget Sound provide some of the finest shellfish habitat in the world, contributing to Washington's position as the nation's leading producer of farmed bivalve shellfish. The region has established a strong record for restoring polluted shellfish waters, upgrading 8,000 more commercial shellfish acres than were downgraded over the past ten years. While these efforts are essential and must continue, they also reveal important lessons and warning signs for future efforts. Pollution problems are surfacing in more areas, are increasingly complex and costly to resolve, and are exacerbated by landscape changes caused by population growth and development. These trends require more far-sighted strategies that shift emphasis away from symptoms and short-term fixes to lasting protection of water quality and watershed functions. New research underscores the need for better land use planning, watershed management and public education that promotes suitable land uses and infrastructure; preserves natural land cover and hydrologic systems; minimizes connectivity between pollution sources and receiving waters; strengthens practices to prevent pollution; establishes indicators and methods to measure landscape changes and cumulative impacts; and helps citizens and elected officials make better decisions to safeguard shellfish growing areas.

Introduction

When European explorers sailed into Puget Sound in the late 1700s they called the beautiful inland waters "the sea in the forest." While the forest remains a prominent feature of the Puget Sound landscape, much has changed in the ensuing two centuries. Thick stands of old-growth fir, cedar and hemlock that once blanketed the terrain have given way to widespread development, especially in the lowland areas of the basin. The changes have been so significant that it might be said that urbanization—defined as the transformation of natural environments to built environments—is now the most prominent feature of Puget Sound's lowland areas. Development has altered not only the region's landscapes, but also the condition of its aquatic habitats and resources.

Figure 1: Productive bottom-culture oyster ground in Totten Inlet, Thurston County, contributes to Washington's position as the nation's top producer of farmed bivalve shellfish (photo courtesy Taylor Shellfish Farms, Inc.).

One such consequence has been the contamination and closure of rich shellfish tidelands—prized habitats that previously supported native tribes for thousands of years. Since 1980, nearly 20 percent of the Sound's remaining commercial shellfish growing areas have been closed to harvest due to pollution from human and animal wastes. Sources of fecal pollution include discharges from municipal sewage treatment plants, on-site sewage systems, stormwater runoff, marinas and boaters, farm animals, pets and wildlife. Contrary to common opinion, most new shellfish closures are not caused by large "point source" discharges, but instead are

caused by diffuse "nonpoint" pollution from such sources as failing on-site sewage systems, farm animal wastes and stormwater runoff.

Today, more than four million people live in the Puget Sound region, accounting for two-thirds of Washington State's population (Figure 2), and over seven million people live in the greater Puget Sound-Georgia Basin region. By 2020, Puget Sound's population is expected to exceed five million and the Puget Sound-Georgia Basin's population is expected to reach nine million (PSAT 2002; WOFM 2002). Puget Sound's population has grown steadily at about 20 percent each decade with some of the highest growth rates occurring in the rural counties where shellfish harvesting remains a cultural and economic mainstay.

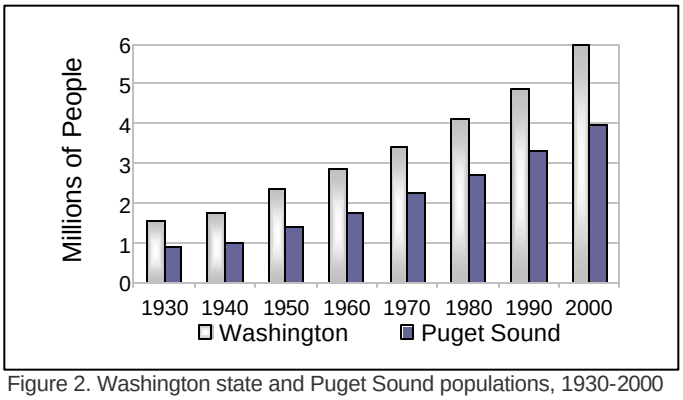

Figure 2. Washington state and Puget Sound populations, 1930-2000 (WOFM 2002).

This tension between continued growth in the region and protection of shellfish growing areas demands a fresh look at the approaches we are using to address the threats and impacts. The approaches outlined in this paper are based in part on a project organized by the Puget Sound Action Team to evaluate the relationship between coastal urbanization and microbial contamination of shellfish growing areas. The project included a literature review and analysis by Glasoe and Christy (2004) and research correlating watershed development and shoreline bacterial levels at selected sites in the Puget Sound region by Alberti and Bidwell (in press). The approaches are also based on findings by May *et al*. (in press) assessing microbial pollution sources and loadings in sub-basins of the Sinclair-Dyes Inlet watershed in Kitsap County, Washington.

Evolution of the Puget Sound Shellfish Protection Program

Efforts to protect and restore Puget Sound's valuable marine waters and habitats gained added attention when the state established the Puget Sound Water Quality Authority in 1985 and adopted the first *Puget Sound Water Quality Management Plan* in 1987. The management plan included a stand-alone program tailored to the protection of shellfish growing areas as well as other programs, such as stormwater management, nonpoint pollution control, and watershed planning, that were designed to support shellfish protection and restoration.

During the early stages of implementation, the region witnessed unprecedented numbers of commercial shellfish downgrades (Figure 3). The closures reflected both declining water quality in many shellfish growing areas as well as enhanced monitoring that revealed pollution problems that had previously gone undetected. By the early 1990s the downward trend began to stabilize as the management programs started to produce results and other tools were applied, including shellfish closure response strategies and shellfish protection districts. By the mid-1990s targeted efforts to control pollution began paying dividends as water quality improved and a few commercial shellfish areas were reopened. In the ten years between 1995 and 2004, restoration efforts successfully upgraded 8,000 more commercial shellfish acres than were downgraded.

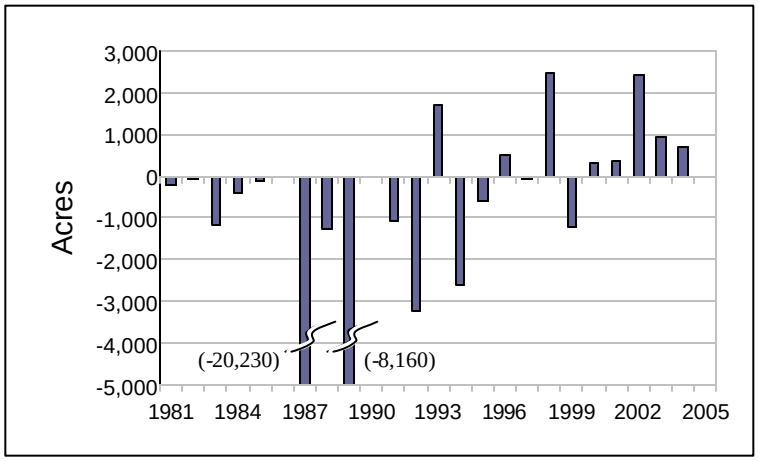

Figure 3: Annual net change in acreage approved for commercial shellfish harvest in Puget Sound due to changes in water quality (based on WDOH 2004 and sanitary surveys for individual shellfish growing areas).

Despite the successes and positive trends, other work during the period raised questions about the sustainability of these strategies and pointed to the need for new approaches to more permanently safeguard

the region's shellfish growing areas. Findings supporting this conclusion include the following:

- continued growth pressures in the region (population, development, land cover change);
- the number of shellfish areas identified as threatened under the Washington Department of Health's early warning system more than doubled between 1997 and 2004;
- the condition and classification of successfully restored shellfish areas are often tenuous, sometimes temporary, and invariably need ongoing and costly attention to maintain the gains and address new impacts;
- stormwater impacts in urbanizing areas are making pollution problems more difficult and costly to assess and correct;
- increased understanding that pollution problems are exacerbated by changes in land cover and watershed hydrology;
- increased understanding that many conventional pollution-control practices do not fully mitigate the effects of development and protect the health and function of aquatic habitats; and
- increased awareness that efforts and investments are often reactive and focus more on symptoms and short-term fixes than on underlying causes and lasting protection.

Restoration strategies and conventional pollution-control techniques will continue to play important roles in the regional effort to preserve shellfish harvest opportunities, but the work must be complemented by more far-sighted approaches that take aim at such essential issues as managing growth, preventing pollution, and preserving the integrity of watershed processes in order to succeed in the coming decades.

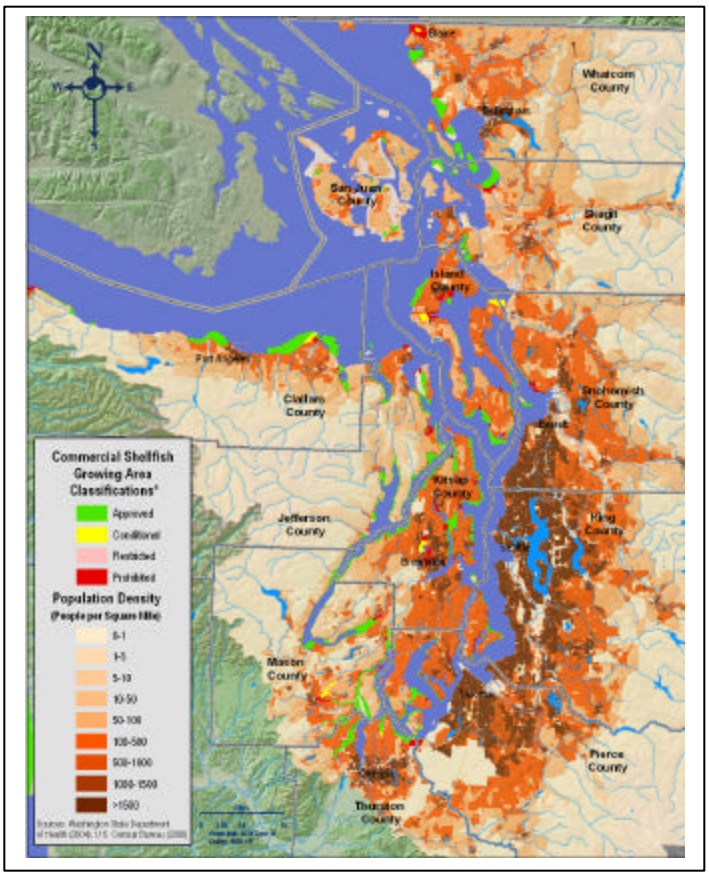

Figure 4. Population densities and commercial shellfish growing area classifications in Puget Sound. Shellfish areas not officially classified are closed to commercial harvest, including the shoreline area along the Everett-to-Tacoma urban corridor.

Essential Strategies for Preserving Watersheds and Water Quality for Shellfish Harvesting

Many of the strategies outlined below are already in use to varying degrees across the Puget Sound region, and a number of authorities and tools are available to support their implementation. Local governments, for example, are equipped with a suite of planning tools and legal authorities for managing growth, shorelines, watersheds, sewage and stormwater. As such, our main challenge is not to substantially reshape these tools and authorities for new uses, but to learn how to use them more creatively and effectively to better preserve watersheds and water quality for shellfish harvesting. The following is an overview of several principles and approaches that are essential to long-term shellfish protection.

Watershed Protection

Watershed protection means preserving the natural features and hydrologic processes that define the functions and character of a watershed. These features and processes include the native vegetation, soils, wetlands, rivers and other elements that govern the storage and movement of water through a watershed.

The condition and classification of shellfish growing areas are a direct reflection of the condition of the surrounding terrain. While there is no universal rule or threshold for determining suitable land uses or for determining how much development is too much development, intense watershed development is generally incompatible with safe, sustainable shellfish harvesting in adjacent tidelands. One of the key reasons for this is that development simultaneously reduces the

natural capacity of watersheds to attenuate flows and break down pollutants while increasing the efficient delivery of pollutants to receiving waters (Figure 5). Strategies to address and mitigate these effects include the following:

- Preserve forest cover and limit its fragmentation. The vegetation and soils of the Pacific Northwest's temperate rain forests are designed to efficiently regulate the storage and movement of massive amounts of water. The services provided by these natural features are irreplaceable for both the protection of water quality and water quantity, and are significantly compromised when lands are cleared and developed.
- Preserve and restore wetland systems and other natural drainage features that work in concert with vegetation and soils to attenuate flows and remove pollutants. Limit channeling, armoring, piping and other hydrologic modifications that increase surface runoff volumes (Figure 6).
- Preserve and restore intact, continuous riparian buffers with mature coniferous vegetation along freshwater streams and marine shorelines.
- Minimize and disconnect impervious surfaces to prevent stormwater runoff and to promote on-site infiltration and subsurface flow. The amount of impervious area that is directly connected to the downstream drainage system is defined as "effective impervious area" and is a key landscape indicator for gauging the effects of development on shellfish growing areas and other water resources.

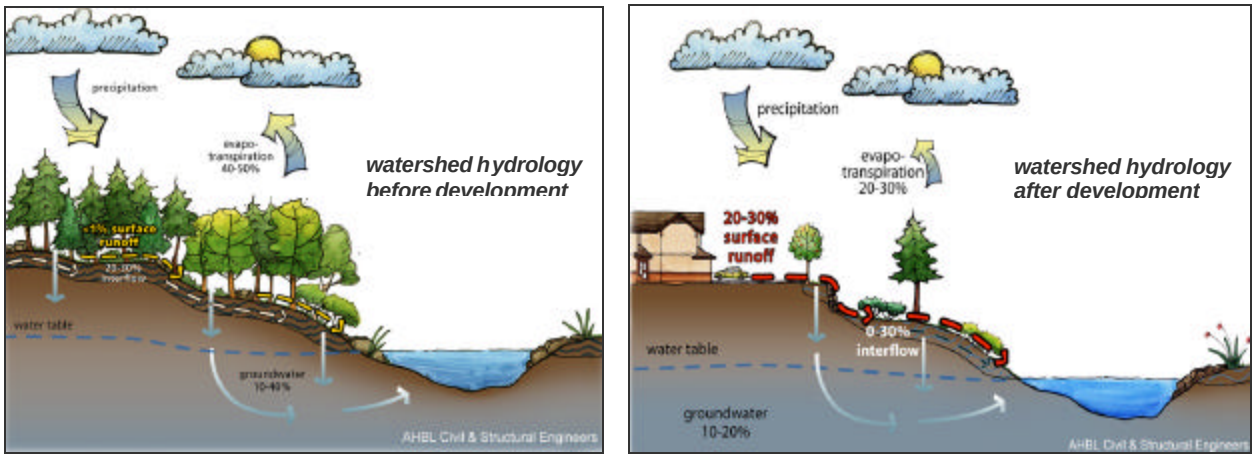

Figure 5. Watershed hydrology before and after development (PSAT and WSUPCE 2005).

Pollution Prevention

Efforts to control pollution and to restore contaminated habitats are costly and complex. Pollution prevention is a prudent approach that makes sense in every situation, including efforts to prevent the contamination and closure of shellfish growing areas. The following approaches hold particularly significant potential for two of the leading pollution problems in shellfish growing areas:
stormwater runoff and on-site sewage systems.

- Stormwater presents a daunting management challenge in the Pacific Northwest. Approaches that prevent the creation of stormwater runoff help prevent related impacts to aquatic habitats. Several of these measures are outlined in the previous section on watershed protection. An additional strategy is to begin implementing low impact development as standard practice in watersheds draining to productive shellfish tidelands. Low impact development involves a suite of site-development practices and small-scale stormwater controls that aim to

Figure 6: Piped stormwater discharging directly to Puget Sound shellfish waters (photos courtesy Liberty Bay Foundation).

preserve and mimic pre-development hydrology to the extent possible. See the *Low Impact Development Technical Guidance Manual for Puget Sound* for more information (PSAT and WSUPCE 2005). While the principles and practices show significant promise in mitigating the effects of development on water resources, it is important to add that low impact development is not a replacement for stormwater management, but instead is part of a comprehensive approach to stormwater management. Similarly, low impact development is not an alternative to sound land use planning, but instead is a tool that can be used at the site-development scale to help mitigate development impacts after the land use planning process has determined which areas and uses should be protected and which areas should be developed.

- On-site sewage systems provide an effective sewage treatment option when the systems are properly sited, designed, installed, operated and maintained. When any of these life-cycle responsibilities are mishandled or overlooked, the systems can malfunction and pollute ground and surface waters. An estimated half million on-site systems are currently in use around the Sound and the vast majority are not yet included in a utility-style management program to ensure periodic inspections and proper maintenance. Such programs are essential for preventing pollution from on-site systems, especially those systems that pose the greatest risk to shellfish tidelands or other water resources because of the treatment method, proximity to water resources, lot size, soils or other factors.

Land Use Planning

Local land use planning is a key vehicle for implementing many of the principles and approaches outlined in this paper. The policies and standards established in the local comprehensive plans and accompanying development regulations guide both current and future development as well as the protection of critical areas and natural resource lands.

The state's guidelines for growth management (Chapter 365-190 WAC) and shoreline management (Chapter 173-26 WAC) both call for the protection of shellfish tidelands as environmentally sensitive areas and as economically valuable aquacultural lands. Although both authorities have been used for these purposes by jurisdictions in the region, there is significant potential for expanded and more creative use in concert with other regulatory and non-regulatory tools. Here are a few key principles and approaches to follow:

- Designate shellfish growing areas as critical areas and natural resource lands under growth management, and as natural or rural conservancy areas under shoreline management. Establish policies and standards in comprehensive plans and development regulations that support long-term protection of these functions and uses.
- Direct development to urban growth areas (UGAs) and limit development densities in shellfish watersheds. Do not extend UGAs into shellfish watersheds. Employ incentive programs to direct growth to UGAs and away from rural areas. In cases where UGAs or LAMIRDS (local areas of more intense rural development) already exist in shellfish watersheds, take aggressive action to mitigate the impacts.
- Set policies and standards to preserve forest cover and to encourage continuity in forest cover; to limit and disconnect impervious cover, including road networks; to preserve wetland systems and associated buffers; to preserve riparian buffers along streams and shorelines; and to limit piping and other drainage modifications for enhanced surface runoff.
- Conduct subarea planning to establish policies and development standards tailored to local conditions and aimed at preserving water quality and watershed functions. Use landscape analysis and other GIS-bases spatial analysis tools to assist in the planning process.
- Amend local plans and standards to require the use of low impact development in shellfish watersheds. Promote rural land uses and development patterns and densities that avoid the use of constructed or hard

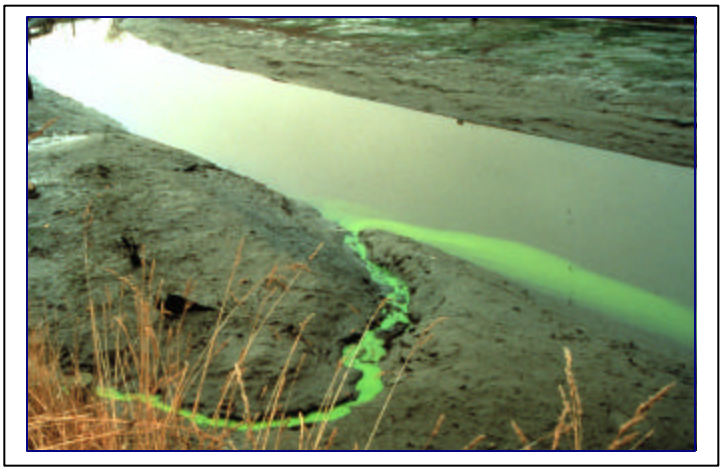

Figure 7: Dye test of a residential sewage system reveals a direct sewage discharge to shellfish growing waters. Management programs are essential to ensure periodic inspections and ongoing maintenance (photo courtesy Washington Department of Ecology).

stormwater infrastructure (i.e., curb-and-gutter collection systems and piped conveyance systems).

- Promote rural land uses and development patterns and densities that support the use of decentralized wastewater systems (on-site and cluster sewage treatment systems) and avoid urban densities that require the use of centralized wastewater systems (sewers and centralized sewage treatment plants). Establish utility-style management programs to ensure periodic inspections and ongoing maintenance of decentralized systems (Figure 7).

Assessment and Adaptive Management

Management approaches that attempt to prevent pollution and preserve healthy watersheds lack the simple trigger and feedback loop that define the restoration approach, i.e., the system breaks and then you try fix it. Management approaches that focus on preserving healthy ecological processes require a more thoughtful and planned set of strategies to assess conditions, track changes, incorporate new information, and redirect efforts over time to keep the system in balance. Here are a few key approaches to incorporate into a shellfish protection program.

- Use the Washington Department of Health's annual growing area reports, shoreline survey reports and other information to track water quality in shellfish growing areas on an ongoing basis and to respond to emerging problems as quickly as possible.
- Set up systems to assess cumulative watershed impacts to ensure no net loss of ecological functions, including clean water for shellfish harvesting. Establish appropriate landscape indicators (e.g., percent impervious cover, effective impervious cover, forest cover) and environmental indicators, such as fecal coliform bacteria levels, to track and correlate impacts over time. Establish benchmarks, targets and feedback mechanisms to guide decision-making and to adjust the management programs.
- Use landscape analysis and other GIS-based spatial analysis tools to evaluate future development scenarios and their effect on watershed habitats and hydrology, and then use the findings to help reshape local land use plans, development regulations and pollution-control programs to more effectively preserve shellfish harvesting and other preferred uses.

Ten Essential Land Use Actions for Shellfish Protection

1. Preserve forest cover.
2. Minimize fragmentation of forest cover.
3. Preserve wetlands and other hydrologic features.
4. Preserve continuous riparian zones with mature, coniferous vegetation.
5. Minimize total impervious area.
6. Minimize "effective" impervious area directly connected to downstream drainage system.
7. Direct growth to urban growth areas.
8. Determine land uses based on suitability for long-term protection and use of water resources.
9. Use low impact development practices and other soft stormwater infrastructure.
10. Use decentralized wastewater treatment systems coupled with effective management.

Conclusions

Given the significant and steady growth pressures in the Puget Sound region, the important question is not whether we will continue to grow, but how we will grow. Will we find ways of accommodating growth while preserving our prized habitats and resources, or will these habitats and resources degrade as a consequence of growth?

The principles and approaches outlined in the paper are a mix of proven and promising strategies that can be used to significantly reduce the effects of development and the related risk of contamination and closure of shellfish growing areas. The approaches reflect the belief that watershed protection and development can coexist within certain limits, but a number of actions must be undertaken to mitigate the most significant and chronic impacts.

It is also worth noting that the approaches closely parallel other recommendations that are emerging for salmon recovery and nearshore restoration which point to healthy ecological processes as the essential framework for long-term protection and restoration of aquatic habitats and resources. Such work may ultimately lead to a unifying set of principles and practices that decision-makers, resource managers, landowners and developers can use to guide development practices across the region.

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